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**CITY OF HAMILTON
SEWAGE TREATMENT PLANT**

ENGINEERING OPERATIONS SECTION

Department of Engineering



**THE CORPORATION
OF THE
CITY OF HAMILTON**

APRIL, 1973

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THE CITY OF HAMILTON SEWAGE TREATMENT PLANT

The City of Hamilton sewage treatment plant, located in the east end of the city, is capable of providing complete treatment for 60 mgd of mixed domestic and industrial sewage, plus limited treatment of an additional 150 mgd of storm flow from the city's combined sewer system.

The primary treatment phase of the city's pollution control program was completed in 1963 at a cost of \$10 million. This primary plant consists of a main lift station, primary clarifiers, sludge digestion system, vacuum filtration and effluent chlorination facilities. Sludge cake was disposed of by landfill on site.

The secondary treatment extension, completed in 1973, provides activated sludge treatment, pressure flotation for excess activated sludge thickening, additional digester and filter capacity, sludge incineration and standby power facilities. The cost of these extensions was approximately \$23 million. Financing was undertaken by the Ontario Water Resources Commission, now the Ministry of the Environment; repayment by the City is to be made over a period of 40 years.

Design considerations have been given to an ultimate plant with the capability of complete treatment of 120 mgd dry weather flow.

The following is a brief description of the plant as related to the site plan:

Main Pumping Station (Location A)

Sewage enters the plant some 78 feet below ground elevation via two interceptor tunnels discharging into a 40 ft. diameter wet well. Five vertical shaft centrifugal pumps, each rated at 50 mgd against 78 ft. head, discharge into a circular channel surrounding the top of the well. Three of these pumps are driven via eddy-current couplings, enabling throughput to be varied according to inflow to the plant; pump speed is governed automatically by wet well level. Provision has been made for an additional three pumps to cater for the ultimate plant capacity.

From the pumping station, the sewage flows by gravity to the detritor building via a concrete channel; flow is measured by a venturi flume located in this channel.

Detritor Building (Location B)

Four mechanically raked 1" bar screens are provided, with facilities for bypassing any or all units for maintenance purposes. Flow then passes to a grit-removal system consisting of four 35 ft. square detritor units. Grit removed is raked mechanically into channels between each pair of detritors and cleaned by a rake classifier prior to land disposal on site.

Also located in this building is a 5,000 gpd pilot treatment plant. This installation is used extensively for studying the effects on biological treatment of various industrial wastes discharged to the sewer system, and for assessing the effectiveness of various nutrient removal processes.

Primary Clarifiers (Location C)

Primary clarifiers are of the rectangular, mechanically scraped type. Raw sludge and scum can be transferred by separate positive displacement pumps to either primary digesters or vacuum filters.

Number of tanks: 8
Dimensions: 250 ft. x 41 ft. x 11 ft.
Total volume: 5.6 m.g.
Total surface area: 81,600 ft²
Retention time: 2.2 hr.
Rise rate: 740 gpd/ft² (4.9 ft/hr)

Aeration System (Location D)

The aeration system consists of 48 cells arranged in 8 rows of 6 units, each cell being provided with a cone-type aerator unit and draft tube. Either conventional or step feeding may be employed, thus providing considerable operating flexibility.

Number of cells: 48 (8 rows of 6)
Aerator motor power: 60 HP
Cell dimensions: 60 ft. x 60 ft. x 15½ ft.
Total aeration system volume: 15 m.g.
Retention time: 6.0 hr.
Design loading: 0.3 lb. BOD/day/lb MLSS
Design MLSS: 2,000 mg/l
Design volumetric loading: 38 lb BOD/day/1000 ft³

Secondary Clarifiers (Location R)

Mixed liquor flows from the aeration section to the secondary clarifiers through two channels, which are aerated to prevent sludge settlement. Each clarifier is provided with a mechanical scraper, so designed that a square tank shape can be used thus making full use of available land area. Clear secondary effluent overflows the clarifier weirs and passes to the chlorine contact chamber (location Q). Sludge flow from each clarifier is measured by magnetic flowmeters before entering the return sludge pumping station (location E).

Number of tanks: 8

Dimensions: 120 ft. x 120 ft. x 10 ft.

Total volume: 7.2 m.g.

Total surface area: 115,000 ft²

Retention time: 2.9 hr.

Rise rate: 520 gpd/ft² (3.5 ft/hr).

Chlorine contact chamber (Location Q)

A contact time of 30 minutes is provided prior to discharge of the chlorinated secondary effluent to Hamilton Bay. A chlorine residual of 0.5-1.0 mg/l is maintained during the summer months. Chlorine gas, delivered by rail tank car to a chlorinator building some 2000 ft. south of the plant site, is conveyed by underground pipes to the ejector system located near the contact chamber.

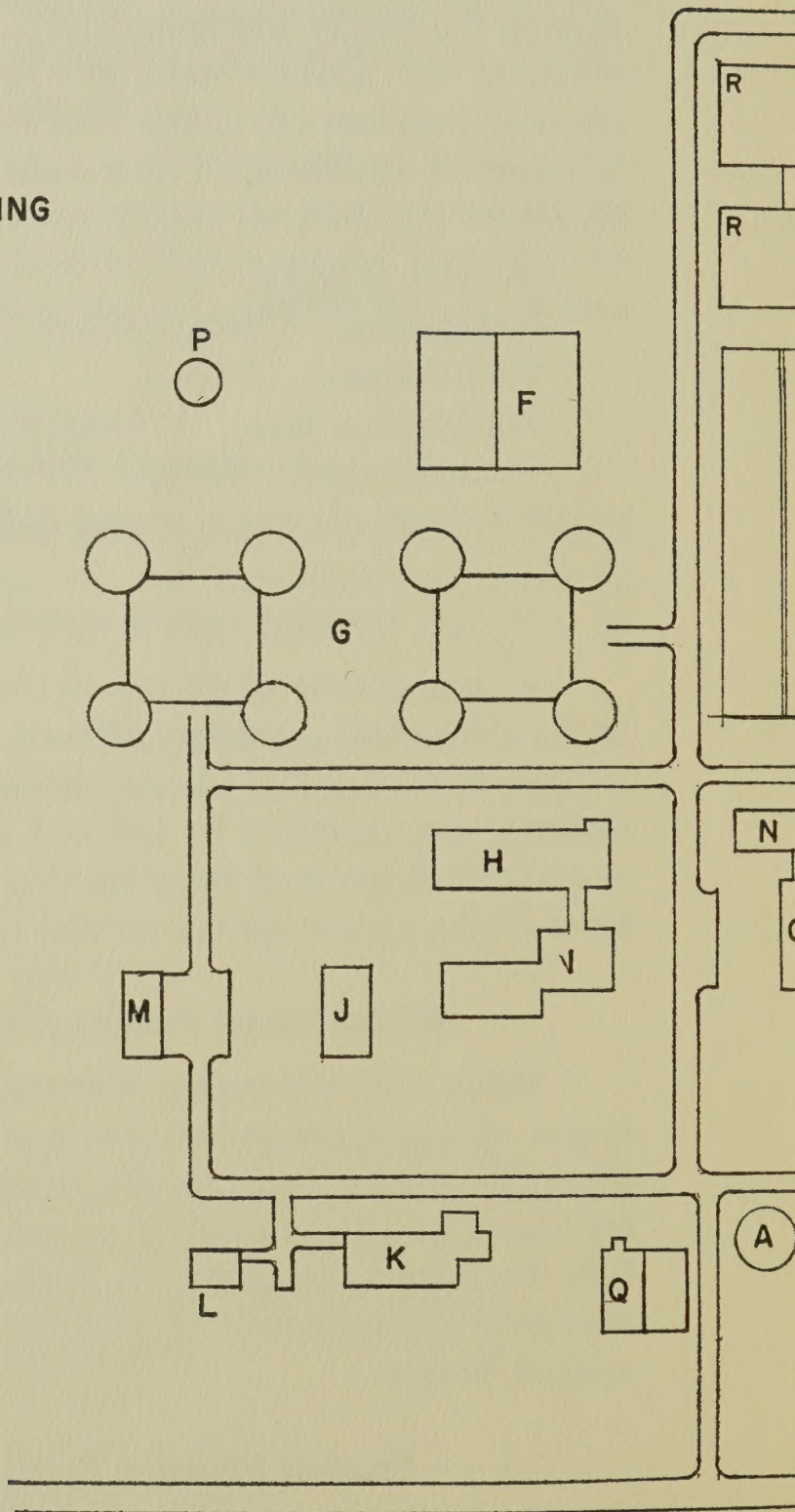
Return Sludge Pumping Station (Location E)

Sludge withdrawn from the secondary clarifiers is lifted by means of four screw pumps into a common sump, from where it flows by gravity back to the inlets of the aeration tanks as recycle activated sludge or is wasted as required to the pressure flotation building (location F). Each screw pump is capable of a maximum throughput of 15 mgd against 14 ft. head when operating at 30 rpm.

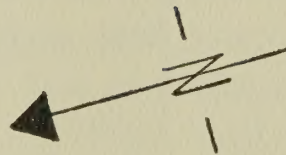
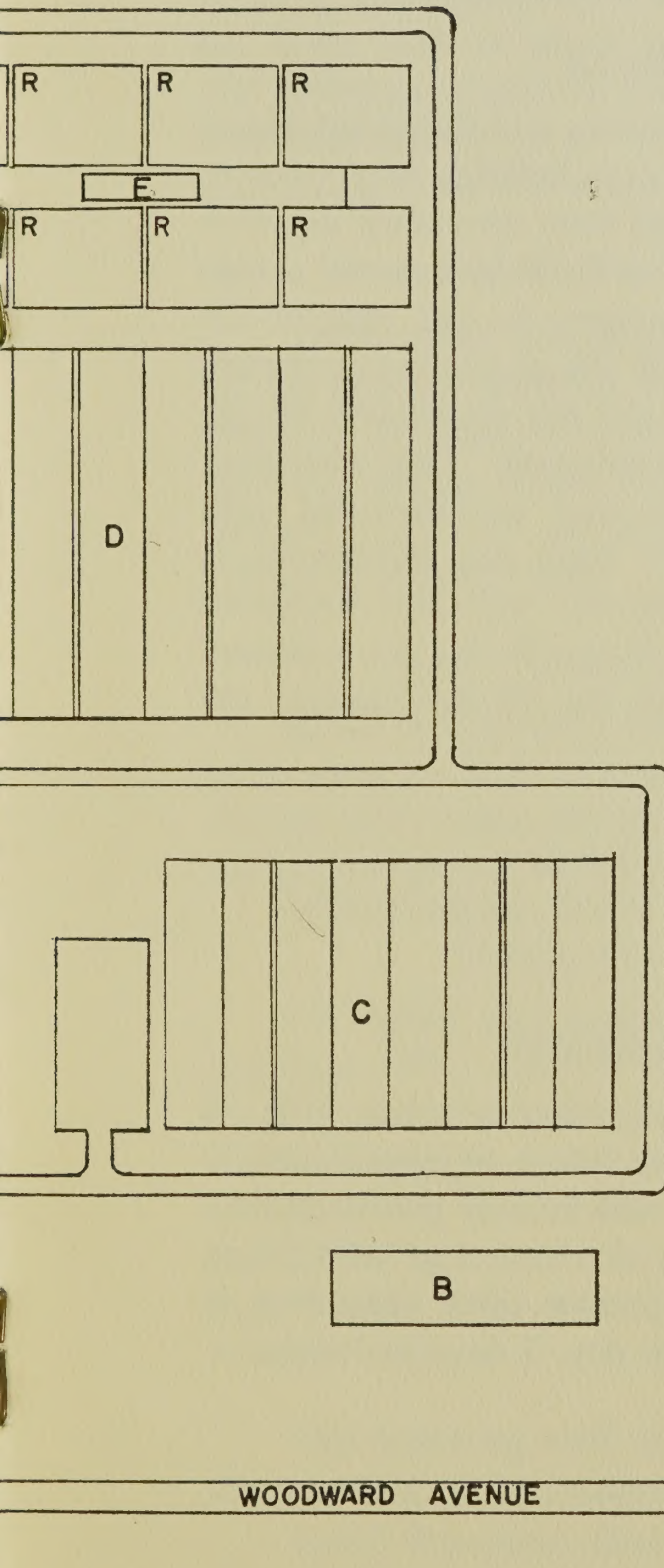
Pressure Flotation Building (Location F)

Excess activated sludge, at a solids concentration of about 0.8%, is thickened to 4.0% by a pressure flotation system. This has been sized to allow operation for two shifts, five days per week. Aerated sludge storage tanks having a total capacity of

A-MAIN PUMPING STATION
 B-DETRITOR BUILDING
 C-PRIMARY CLARIFIERS
 D-AERATION SECTION
 E-SCREW PUMPS
 F-PRESSURE FLOATATION BUILDING
 G-DIGESTERS
 H-VACUUM FILTER BUILDING
 I-BOILER ROOM
 J-INCINERATORS
 K-STANDBY POWER BUILDING
 L-ELECTRICAL SUB-STATION
 M-TRUCK GARAGE
 N-LABORATORY
 O-MAIN CONTROL ROOM
 P-METHANE GAS SPHERE
 Q-CHLORINE CONTACT CHAMBER
 R-FINAL CLARIFIERS



CITY OF HAMILTON
DEPARTMENT OF ENGINEERING
OPERATIONS SECTION
SITE PLAN-SEWAGE TREATMENT PLANT



DATE: FEBRUARY 9, 1972

1.0 m.g. are provided. Polyelectrolyte conditioning of the feed sludge is employed.

Number of units: 4

Total surface area: 1600 ft²

Design sludge loading: 3.1 lb dry solids/hr/ft²

Digesters (Location G)

Raw sludge from the primary clarifiers and thickened excess activated sludge from the pressure flotation building is pumped to the digestion system. Four primary and four secondary digesters are provided; the primaries are heated to 90°F by external sludge recirculation via hot-water heat exchangers. In the case of the two new primaries installed as part of the secondary treatment phase, gas mixing has been substituted for the mechanical mixing system employed in the original installation. The secondary digesters are unheated and unmixed, and are provided with floating steel roofs. Supernatant liquor from the secondaries is recycled to the main pumping station wet well and thickened digested sludge pumped to the vacuum filters. Sludge gas produced is compressed and stored at 50 psi in the 80 ft. diameter gas sphere (location P).

Total digester volume: 14 m.g.

Primary digester retention time: 40 days

Primary digester solids loading: 0.06 lb. volatile solids/
day/ft³

Vacuum filtration (Location H)

Digested sludge, at a solids concentration of about 11%, is dewatered on four coil-spring vacuum filters to approximately 28% dry solids. Either ferric chloride and lime or polyelectrolyte sludge conditioning may be employed; the latter has been found to be superior and is in use at the present time. Operation is carried out on the basis of two shifts per day, 5 days per week.

Number of filters: 4

Total area: 2,000 ft²

Solids throughput: 8 lb/hr/ft²

Incinerator Building (Location J)

Two circular, mechanically rabbled, multiple hearth air-cooled sludge incinerators are provided. Each is designed to handle 10 tons of sludge cake per hour at a moisture content of 80%, corresponding to a total capacity of 2 tons of dry solids per hour. Natural gas is employed as an auxiliary fuel source. Air pollution control is provided by wet scrubber systems using secondary effluent as the cooling medium; the ash slurry produced is disposed of on site as landfill.

Standby Power Building (Location K)

Three diesel-driven generators are installed in this facility for the primary purposes of supplying power to the main sewage pumps in the event of a Hydro power failure, and reducing plant demands during Hydro system peaks. The units are capable of operating on either sludge gas or diesel oil and have an output of 1,000 kW at 4,000 volts.

Boiler Room (Location I)

Steam is generated for plant space heating and process requirements by four sludge or natural gas fired boilers rated at 10,000 lb/hr each. Steam is also supplied to the nearby water purification plant.

Design, Construction and Operation

The plant was designed by Proctor & Redfern Consulting Engineers. The General Contractor for the primary plant was Pigott Construction Co. Ltd. and McDougall Construction Ltd. for the secondary treatment phase. The staff comprises some 78 operating and maintenance personnel. Sewage treatment is one part of the Operations Section of the Department of Engineering and, as such, is the responsibility of the City Engineer, Mr. W. A. Wheten, P. Eng.

The following staff are responsible to the City Engineer for the operation of the treatment works:

Leslie Sharman—Director of Engineering Operations

David Harris—Assistant Director of Engineering Operations

Neil Gross—Plant Superintendent

Cyril Maling—Superintendent of Maintenance



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